Marine Life Protection Act Initiative

Public Comments Submitted

through May 5, 2010

From: Roberta Cordero
Sent: Friday, April 30, 2010 2:17 PM
Subject: Re: Tribal issues

Hi again,

I just got permission from Intertribal Sinkyone Wilderness Council to forward the attached doc, which is an outline of Curtis Berkey's presentation at the meeting.

see ya
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On Fri, Apr 30, 2010 at 12:37 PM, Roberta Cordero wrote:
Hello friends,

I want to bring you up to date with what information I have concerning the April 9th Tribal/DFG meeting and related MLPAI issues. Would it be appropriate at our Sunday evening get-together to provide time for this along with Meg's and Ken's impressions, etc.? (Dinner at 7:00 p.m.)

Sonke's summary of the meeting is not quite complete (he is on vacation this week). I spoke with Becky Ota this morning and we're hoping to be able to say it will be ready to send to all participants within a few days. As this was *not* a public meeting, and was *not* an MLPAI-sponsored meeting, we need to be clear (or get clear!) on how this goes out. My understanding is that it would not be a public document. In any case, I will bring my notes--and I know Meg has some excellent notes--and we can give you an oral summary.

The Intertribal Sinkyone Wilderness Council is also developing a summary and I will find out if we can have access to it for our meeting.

I think Virginia was also approached about this, but Kaitilin Gaffney sent the ideas appended below to Meg and me this morning. I think they're good ideas and ran them by Becky and she thinks they look OK from a DFG standpoint, so I'd love to discuss whether or not we should implement this suggestion. Just got an email from Meg about this with some additional supportive ideas. (Meg, I'll leave it up to you to put those to all of us.)

And one last item, the Yurok Tribe is drafting MLPA-amendment proposed legislation vis-a-vis tribal usage and has been getting comment and input from other tribal people. If Megan Rocha gets the go-ahead from her Council, she'll be able to share that with us at the BRTF meeting.

See you in a few days, and looking forward.

Best,
Roberta

From Kaitilin Gaffney:

Dear Meg and Roberta:

Given the many challenges involved in addressing the complicated issues around tribal uses and the MLPA, it appears unreasonable to expect the RSG to address these issues in their MPA planning process. There appears to be wide spread agreement on the RSG about the importance of respecting tribal uses but the current BRTF

guidance is not sufficient to allow RSG to move beyond this issue and it continues to bog down efforts to design MPAs. We have heard from a range of interests that allowing the RSG to include broad language about respecting tribal uses and making clear that the specifics of how to address tribal uses will be handled further up the chain by DFG through a parallel process and through consultation with tribes on individual MPAs would greatly assist in RSG's ability to move forward with their charge.

The request is that the BRTF add guidance to the RSG along the lines of the following:

BRTF recommends:

(1) That during the MPA design process, the NCRSG gem groups can include specific language within descriptions of proposed MPAs regarding non-commercial tribal subsistence gathering of marine life, and spiritual, ceremonial, and traditional cultural activities;

and

(2) That DFG pursue a parallel process to investigate ways to translate allowance of tribal harvest into regulations, including engaging in site-specific consultation with individual tribes as appropriate based on final placement of proposed MPAs.

Thank you for your attention to this important issue!

Outline for Aboriginal Rights Presentation

By Curtis Berkey for

Meeting with Department of Fish and Game and Coastal Tribes

April 9, 2010

What are the fundamental principles of "black letter" Indian law:

1. Indian nations were here first and certain rights derive from that status. Aboriginal rights existed before the creation of the United States. First recognized by the US Supreme Court in 1823.

2. Aboriginal rights are inherent, not delegated or given by other governments

3. Aboriginal rights do not require governmental recognition to be enforceable

    No treaty, statute, executive order required

4. Aboriginal rights apply to:

    Land–Indian title
    Self-government–sovereignty
    Use (hunting, fishing and gathering)–either part of or separate from

5. Aboriginal rights can exist in the Tribe or in individual Tribal members

6. Established by "actual, exclusive and continuous use and occupancy for a long time."

    Exclusive use means to the exclusion of other Indian Tribes (unless two Tribes agree to jointly occupy and/or use the same area)

"Long time"–no set period of time required

Long enough for the Tribe to have transformed the area into its domestic territory

One court has said 20 years is long enough

"Use"–actual habitation or ways of life, customs and habits such as hunting, fishing and trading

7. Aboriginal rights can be lost in only two ways:

   a. Act of Congress- "plain and explicit extinguishment" required

   b. Voluntary relinquishment by treaty or affirmative abandonment

How do these principles apply in California?

1. Most all Tribes have shown or are able to show use and occupancy necessary to establish aboriginal rights to land and resources

   This should be the starting point for any discussion of this issue

   This does not appear to be a contested point

2. Tribes here have not voluntarily given up their aboriginal rights

   Treaties negotiated and signed were not ratified, so they cannot be the basis for cession of aboriginal rights

   Unaware of any other agreements of relinquishment

3. Congress has not plainly and explicitly extinguished aboriginal title in California

4. Several other responses to assertions of aboriginal title

a. Indian Claims Commission Award and Judgment

Money awarded by lands lost in 1853 by operation of the California Land Claims Commission (failure to present claims within five years)

Even if understood to extinguish title, the decision applied only to lands within California, and three miles ocean and tidal zone (per the MLPA) was not within that area in 1853.

b. California Lands Commission of 1853

Failure to present claim extinguished title as of 1853

Applied only to titles derived from Mexican law

Aboriginal title can arise in subsequent years even if Commission extinguished titles in 1853 (Cramer v. United States, 1923 California case)

Did not extinguish individual aboriginal titles

c. Creation of National Forests

Leading case on this issue was based on a stipulation that a taking of the Indian title had occurred

There are no cases holding that creation of national forests alone is sufficient to extinguish aboriginal title

Conclusion:

Question of aboriginal title requires individualized analysis of facts and law applicable to specific Tribes and their unique histories and experiences.

April 30, 2010

Blue Ribbon Task Force
Marine Life Protection Act Initiative
c/o California Natural Resources Agency
1416 Ninth Street, Suite 1311
Sacramento, CA 95814

Re: Marine Life Protection Act (MLPA) Initiative Science Guidelines

Dear MLPA Initiative Blue Ribbon Task Force Members,

During the Regional Stakeholder Group planning process it has been repeatedly stated that we "need" to meet the science guidelines. This is leading many stakeholders to believe that their involvement in the process has no utility. Indeed, if there is a predetermined outcome to fully meet the science guidelines, then the current level of stakeholder involvement is unnecessary. There are a limited number of marine protected area (MPA) array designs that meet the science guidelines. Assuming that the science guidelines must be met, MLPA Initiative staff could identify the different options which meet the guidelines, and with stakeholder input the Blue Ribbon Task Force could pick among those options. There would be no need for the extensive stakeholder deliberations that are currently occurring.

However, when the guidelines were adopted, the Science Advisory Team (SAT) did not have the habitat or socioeconomic data we have now. Furthermore, the SAT does not have the local knowledge brought to this process by the Regional Stakeholder Group. Hence, when the SAT adopted the science guidelines, they could not adequately assess the socioeconomic or ecological consequences that would result by meeting the guidelines. Furthermore, because the North Coast science guidelines are the same as used in the South Coast, it is apparent that the guidelines do not account for local ecological, physical or socioeconomic conditions. This is not necessarily a problem, as long as we recognize that the science guidelines are *guidelines* and not *rules*.

As has been recognized by MLPA Initiative staff, the North Coast is a unique area. There is more then one way to meet the goals of the MLPA and I am hopeful that the MLPA Initiative is willing to work with local communities to meet MLPA goals in a way that is sensitive to local conditions and desires. This will not be achieved if the science guidelines are treated like rules and we fail to recognize the unique features of the North Coast. I urge other stakeholders and all MLPA Initiative participants to be open minded as we explore the best way to meet the goals of the MLPA.

Sincerely,

Adam Wagschal
Regional Stakeholder Group Member

From: Tim
Sent: Tuesday, May 04, 2010 8:18 AM
To: MLPAComments
Subject: North Coast fishing regulations

One thing that the SAT has made abundantly clear is that good fishery management is at least as important if not more important than Marine Reserves for managing fish stocks. The North Coast has the most restrictive regulations on the entire West Coast. A 3 month season in Shelter Cove compared to 10 months in Southern Cal and a year round season in Oregon. This is not because of a lack of abundance in fish stocks but just the opposite. Yelloweye rockfish have been declared "overfished" on the entire West Coast by the PFMC, the federal body that regulates fisheries on the West Coast. Yelloweye are not allowed to be retained anywhere off of the continental west coast. However, there is still a "quota " for yelloweye to account for released fish that may die after being caught (release mortality)accidentally while fishing for other more abundant species. Because of the abundance of yelloweye in Northern California, especially around Shelter Cove and Punta Gorda, Northern California reaches its "quota" in 3 to four months while Oregon does not reach its "quota" in a year. So Northern California usually does not come close to catching its quota of other more abundant species like ling cod. Because of their long life span and the age at which they reach breeding maturity yelloweye rockfish are not expected to reach rebuilt status for about 50 years. The good news is that they are rebuilding as evidenced by the stock assesment completed last year. Because of the strict regulations in Northern California other species are being fished at such low levels that the stocks are incredibly healthy. In fact, California Fish and Game is currently trying to figure the best way to increase the limit on ling cod while not affecting the rebuilding timeline for yelloweye rockfish. Tim Klassen

From: Tom Meredith
Sent: Tuesday, May 04, 2010 5:47 AM
To: MLPAComments
Subject: MLPA

To Whom it May Concern,
I am planning a trip down the California coast by boat. I was planning to spend up to 5 months transiting the area, and enjoying the local culture, and attractions. As a fisherman that enjoys keeping only what can be eaten fresh that day, my plans have changed. We will probably spend some $50,000 LESS than originally planned, just in marina, and docking fees. The effect on local shops, grocery, car rental….the list goes on and on. This is a small impact in the grand scheme of things. I fear that I am not the only yachtsman changing their travel plans because of this legislation. My plans to purchase property, and make San Diego a second base of operations are definitely out.
I thought you should be aware of one individuals impact on the State's economy. I fear your local impact from residents, combined with tourist dollars, will make for a very negative economic result. I do not claim to be a scientist, but as a lifelong boater and fisherman, I have found that the fisherman, not the scientists, have a much better idea of species populations and distribution. You should consider listening more carefully to the people in the field, than the scientist behind the desk who is being pressured by political forces.
Sincerely,

Capt. Edwin T (Tom) Meredith IV
Vessel: Little Goose
P.O. Box 414
Big Horn, WY
82833
307-672-9471 Home/Office
307-751-2471 Cell
etm4@littlegooseranch.com

Public Comment
BRTF Mtg. May 3-4
Submitted by Judy Trumper

Informative Document

Prepared by request of the California Sea Urchin Commission
March 2010

Sea urchin dynamics and community-based marine protected areas

The role of herbivores, and sea urchins in particular, in structuring shallow temperate subtidal reef systems has been documented in different systems and regions around the world (Shepherd, 1973; Lawrence, 1975; Breen and Mann, 1976; Chapman, 1981; Andrew and Choat, 1982; Choat and Schiel, 1982; Duggins, 1983; Dean et al., 1984; Harrold and Reed, 1985; Fletcher, 1987; Vadas et al., 1986; Chapman and Johnson, 1990; Andrew, 1991, 1994). Sea urchins are important members of subtidal reef communities because some species can overgraze fleshy macroalgae to create barrens habitat and still persist in high population densities (Johnson and Mann 1982). As a result, a sharp decrease in primary production is generally associated with this transition of rocky reef habitats dominated by macroalgal beds to barrens habitat dominated by crustose coralline algae. Further, such deforestation events can wipe out entire algae (e.g. *Macrocystis pyrifera*) populations with concomitant decreases in the abundance of various associated algae. This generates well documented changes in community composition and repercussions for rocky-reef ecosystem structure and functioning (Dayton 1975a,b; Dayton et al 1984; Schmitt and Holbrook 1990; Sala et al., 1998; Gagnon et al 2004). In California, population explosions of kelp grazers, and sea urchins in particular, resulted in kelp deforestation and transition to barrens at a variety of scales (Leighton 1971, Lawrence 1975, Foster and Schiel 1988, Steneck et al 2002 and references therein).

Possible mechanisms underpinning the creation of barrens relate with either a change in sea urchin grazing behavior or an increase in their density. A behavioral shift where cryptic individuals emerge to overgraze attached algae may result from either decreased predator abundance (Bernstein et al., 1981; but see Vadas et al., 1986; Elner and Vadas, 1990) or decreased availability of drift algae (Harrold and Reed, 1985). Alternatively, increases in sea urchin population density and subsequent barrens formation can potentially arise from decreases in predator abundance (Estes and Palmisano, 1974; Duggins, 1980; Wharton and Mann, 1981; Vadas and Steneck, 1995; Steneck, 1997) or unusual massive recruitment events (Hart and Scheibling, 1988). The importance of predators structuring sea urchin populations has been long discussed, with relatively little obvious evidence except in the case of the sea otter (*Enhydra lutris*) as a key predator of sea urchins at some sites in the northeastern Pacific (Estes and Duggins, 1995; Estes et al., 1998). In addition, abundant evidence support the importance of teleost fish in the northwestern Atlantic (Vadas and Steneck, 1995; Shears and Babcock, 2002) and rock lobsters in South Africa (*Jasus* spp; Mayfield and Branch, 2000; Mayfield et al., 2001) in regulating sea urchin populations, and that the

regulatory effect is influenced by fishing of these predators. In California, lobsters and sheepheads are the main predators of sea urchins and potentially regulate its populations (Tegner and Levin 1983; Cowen 1983). Pycnopodia have also been shown to be predators of Sea Urchins in California (Duggins 1983) . However, whether predators can be capable of naturally control sea urchins populations and hence maintain healthy kelp ecosystems depends on the system and species. Predation upon sea urchins is generally higher where predatory fish are abundant and large (e.g., within MPAs; Sala and Zabala, 1996; Guidetti, 2006). However, the patterns observed are not consistent in time, at large spatial scales, or in different systems around the world (Sala et al. 1998; Guidetti 2006; Guidetti et al. 2005; Micheli et al. 2005). For example, Andrew and Choat (1982) found no evidence of an effect of fish predation on densities of sea urchins within a marine reserve in New Zealand. Further, Shears and Babcock (2004) stated that, while increased predation may affect sea urchin population structure and density, only under certain environmental conditions are these changes likely to result in cascading effects on algal communities. Further, as stated by Sala et al. (1998), other processes (i.e. recruitment, pollution, disease, large-scale oceanographic events, sea urchin harvesting, food subsidies, and availability of shelters) may also be important in regulating the structure of algae assemblages. In summary, natural control of sea urchin population by predators may or may not occur, depending on the biological, ecological and environmental conditions of a particular system.

Sea urchins and abalones generally share similar food and habitat preferences in kelp forest communities around the world (Tegner and Levin 1982; Davis et al. 1992; Guzman del Proo, 1992) and competition between these two taxa for space and/or food has been documented worldwide (Shepherd 1973; Tegner and Levin 1982; Andrew and Underwood 1992 and references therein). Along the California coast, abalone (*Haliotis* spp.), red sea urchins (*Strongylocentrotus franciscanus*) and purple sea urchins (*S. purpuratus*) feed primarily on the same species of macroalgae and have been described as potential competitors for food and space (Tegner and Levin 1982). In addition, sea urchins capability of overgraze kelp beds with consequent formation of barrens can deprive other herbivores, such as abalone, from food sources. In this respect, and motivated by fishermen's concern that urchin-dominated barren areas were increasing in New South Wales, Australia, Andrew et al. (1998) carried out a sea urchin (*Centrostephanus* sp.) removal experiment to assess potential benefits in abalone populations. Thirty replicates of at least 1000 m^2 were used to compare different patterns of sea urchin removals. Clearing the echinoids led to a habitat shift from coralline crusts to a range of foliose algae, accompanied by an order-of magnitude increase in abalones. They suggest the potential benefits of an incipient sea-urchin fishery in enhancing abalone populations and they advocate the development of an experimental approach to co-management of the two species. Moreover, Tomascik and Holmes (2003) assessed the distribution and abundance of pinto abalones (*Haliotis*

kamtschatkana) in relation to habitat, competitors and predators in the Broken Group Islands, BC, Canada. They found a positive correlation between abalone size and the abundance of benthic macroalgae and an inverse relationship between abalone size and the abundance of red sea urchins (*S. franciscanus*). Further, in northern California, Karpov et al. (2001) explored spatial interactions and apparent competitive effects among red abalones (*H. rufescens*), red sea urchins (*S. franciscanus*), and purple sea urchins (*S. purpuratus*) in an area where fishing has large impacts on both taxa, and at unfished reserve sites in which invertebrate density and food availability differ. They found an inverse correlation between adult red abalone and red sea urchin abundance when density of either or both species was high. Their results suggest that differences in density, depth, and food availability play an important role in the observed spatial patterns of red abalones and red sea urchins. They suggest that an intense fishery for red sea urchins appear to have had a positive effect on kelp availability, and abalone growth and abundance. Ultimately, red sea urchin removal led to an increase in red abalone abundance even at a site that was heavily fished by recreational abalone fishers, while at a nearby reserve site where kelp populations are lower, red abalones have declined in abundance as red sea urchins increased. Finally, preliminary analyses of sea urchin and abalone data collected by the California Department of Fish and Game (CDFG 2010) in two different sea urchin closures areas, Caspar and Salt Point, show a similar inverse relationship between densities of both taxa (Fig. 1a and b).

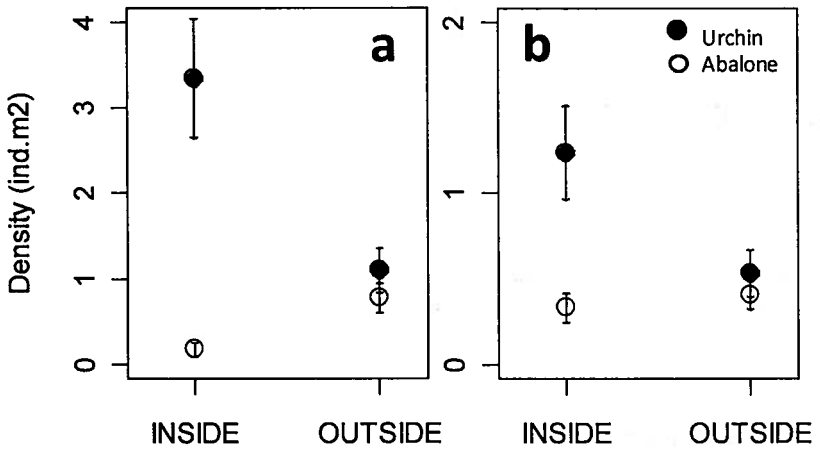

Figure 1. Mean densities for sea urchin and abalone inside and outside (a) Caspar closure for the period 1989-2008; and (b) Salt Point closure for 2008.

This analysis should be considered preliminary and exploratory, since the availability and the temporal coverage and replication of data available so far doesn't allow the use of robust statistical methods. However, difference in sea urchins densities inside and outside the reserve were significant in both cases ($p<0.005$ and $p<0.010$ for Caspar and Salt Point respectively). Abalone densities inside and outside Caspar were significant ($p<0.05$) yet not significant in Salt Point ($p>0.05$). An incomplete time series of sea urchins and abalone densities inside the Caspar reserve show, although not significant ($p>0.05$), some visual trends of increase in sea urchins and decrease in abalones. Additional data, especially missing years, should be included in order to confirm or reject such trends (Fig. 2).

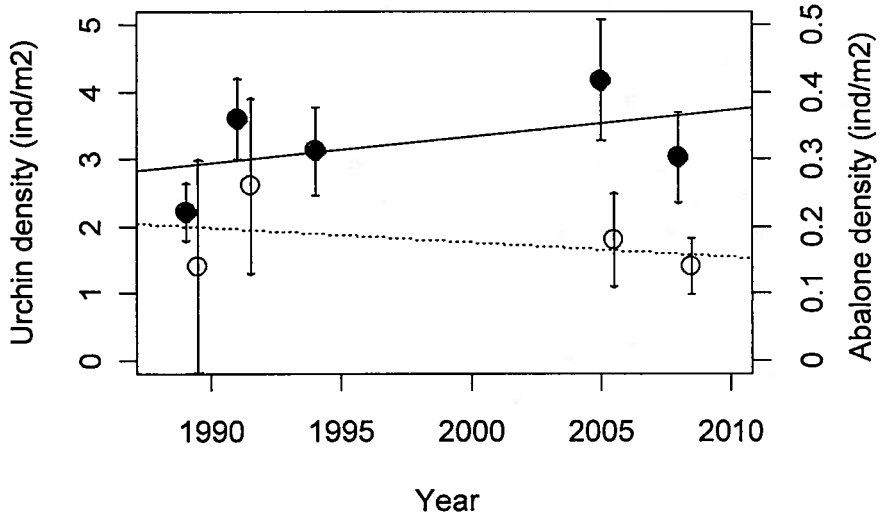

Figure 2. Time series of sea urchin and abalone densities inside the Caspar marine reserve (mean ± SE; Coefficients were positive and negative for sea urchin and abalones respectively, although linear model fits were not significant in both cases; $p>0.05$)

In addition, percentage of algae coverage available for sea urchins (i.e. sub-canopy and canopy) showed a drastic decline after the Caspar/Salt Point reserve was established (Fig. 3), possible supporting the concept of overgrazing by an increased sea urchin population

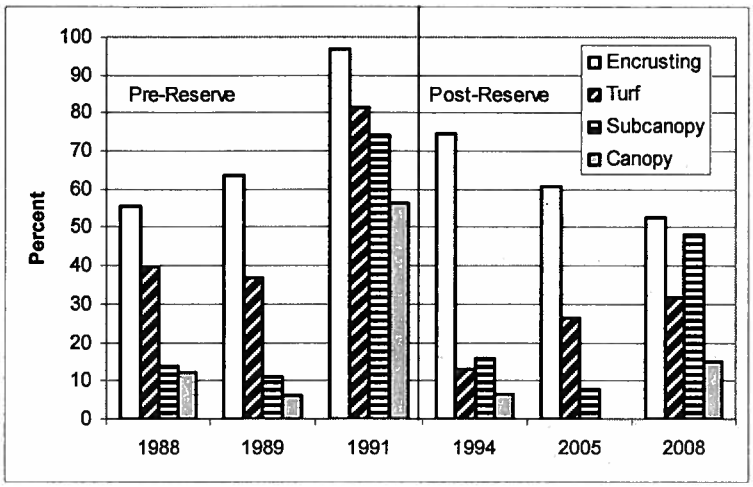

Figure 3. Percentage of algae coverage by type measured along bottom inside the Caspar closure area, period 1988 – 2008. After CDFG (2010).

In contrast with the competitive relationship observed between adult urchins and adult abalone, adult sea urchins may act as facilitators of juvenile recruitment, either providing physical protection for juvenile abalone under their large spine canopy (Tegner and Dayton, 1977; Tegner and Butler, 1989), and/or maintaining coralline algal patches by intense grazing, which have been shown to result in increased abalone settlement (McShane, 1992). Day and Branch (2000) showed a strong, positive relationship between urchins (*Parechinus anguwsus*) and abalone (*Haliotis midae*) in the southwestern Cape, South Africa. Of the juvenile abalone sampled, more than 90% were found beneath sea urchins. In addition, Rogers-Bennet and Pearse (2000) stated that red sea urchin may provide an important cryptic microhabitat for juvenile abalone sheltering beneath urchin spines in shallow waters. They investigated the abundance of juvenile red abalone (*H. rufescens*) and flat abalone (*H. walallensis*) on protected and fished rocky shores in northern California, finding that one third of the juveniles inside the MPAs were found under the urchins' spine canopy. However, the abundance of juvenile red abalone was not correlated with the abundance of conspecifics adults. Tomascik and Holmes (2003) implied a similar interaction, but only seven percent of total number of juvenile abalone (less than or equal to 45 mm) was found under the red sea urchins' spine canopy. However, given the importance of sea urchins' spine canopy for juveniles of their own species, these studies should have evaluated the competition for that microhabitat under high sea urchin densities. Another important consideration

to study is the survival of juvenile abalone over time under high sea urchin densities and the likely competition for food.

Despite the variability of ecological conditions affecting sea urchin populations and consequent overgrazing of kelp communities, and the intra and inter-specific role of sea urchin in structuring rocky shore communities, the negative impacts of overgrazing and transition to barrens are quite convincing. Main effects may include losses in productivity and biodiversity (Tegner and Dayton 1981, 1987; Holbrook et al. 1990; Herrera 1998; Babcock et al 1999, Graham 2004 and references therein) and loss of habitat suitable for feeding and breeding fish and invertebrates (Brito et al. 2004). Thus, controlling sea urchin population by means of calcium oxide (quick-lime; Wilson and North 2009 and references therein), releasing fishing pressure on its predator (e.g. lobsters and sheepheads; Tegner & Levin 1983; Tegner & Dayton 2000) or by developing targeted fisheries (Sala et al 1998; Guidetti et al 2004) has been a common practice in various systems around the world and in California in particular.

A significant amount of studies show the effectiveness of marine protected areas (MPA), and marine reserves in particular, as conservation tools when they are placed and designed properly. Marine reserves are often established with fisheries enhancement objectives or biodiversity conservation goals. Recently, studies have begun to address biodiversity conservation through community wide changes due to marine reserves. In this respect, community state transitions between barrens and kelp forests due to marine reserves have been documented in various systems worldwide. This appears to be due to indirect effects of banning fishing , which cascade down the food chain to produce a community shift (e.g. more lobsters = fewer urchins = more kelp). Several studies indicate that releasing fishing pressure on urchin's predator (e.g. lobsters) may control sea urchins populations and allow kelp beds recovery (Babcock et al 1999; Steneck et al 2002 and references therein). However, where natural predators aren't capable of controlling herbivores populations, overgrazing may cause a decrease in macroalgae abundance and productivity, with a transition to barrens as an extreme case (Sala 1997; Davenport and Anderson 2008). Some examples of drastic changes in community compositions inside no-take marine reserves include (i) two examples in Kenya, one at the Mombassa National Park where the exclusion of artisanal fishers for several years, in conjunction with manipulative programs to reduce sea urchin populations demonstrated that herbivores mediated competition between algae and coral (McClanahan 1997), and the other at the Watamu National Park where increased herbivory slowed of the recovery of macrophytes and caused a switch toward dominance of calcareous algae (McClanahan et al 2002); (ii) a study in northern and central Chile where abundance of limpets inside human-exclusion 'no-take' areas, were coupled with a drastic decline in the abundance of macroalgae with extensive food-web modifications (Oliva and Castilla 1986); (iii) in South Africa, selective fishing on mussels

and limpets increased species richness and the substrate showed a significantly greater cover of sessile unexploited species (e.g. macroalgae; (Hockey 1994); (iv) in Ustica, Italy, the lack of human fishing pressure after the instauration of a protection regime caused a sharp increase of urchins density with consequent transformation of algal assemblages into barren areas, dominated by a few species of encrusting algae (Gianguzza et al 2006). These community and food web modifications may lead to losses in biodiversity and productivity, undermining the overarching objectives of MPAs. In this context, the examples mentioned have developed regulated selective fishing or experimental removals practices in order to control key dominant species and avoid drastic changes in community composition and structure.

Another important benefit of regulated fishing inside MPAs is the inclusion of fishermen and stakeholders in the regulatory and enforcement process. Cooperation in MPA implementation and enforcement and in resource management by local communities of users has been shown as a critical step in attaining the specific objectives behind these protected areas worldwide (Africa: South Africa, Kenya; Asia: Philippines, Bangladesh, Japan; Oceania: Vanuatu, Samoa, Australia; North America: USA, Canada, Mexico; South America: Brazil, Chile, Peru; and Europe: Italy, France, Sweden, UK; Gutierrez and Hilborn in prep.) In addition, community-based MPAs that are periodically harvested are increasingly being implemented as fisheries management tools. Some examples of local community involvement in implementing and enforcing MPAs include: (1) coral reefs in Vanuatu, where a periodical fishing inside the reserve has demonstrated both ecosystem and fishing benefits (Bartlett et al 2009); (2) cooperative fishing in the Gulf of California, Mexico, where MPAs are the core component of the management system (Cudney-Bueno and Basurto 2009); (3) a cod fishery in the Baltic sea, where fishermen participation in fishery regulations inside a MPA improved rule compliance and led to a sustainable fishery (Suuronen et al 2010); Further, Pollnac et al. (2010) show in a recent review of 127 MPAs published in the Proceedings of National Academy of Sciences that high levels of compliance with reserve rules were more related to complex social interactions, such as fishermen incentives and community cohesion and leadership, than simply to enforcement of reserve rules.

Finally, besides the implementation and enforcement benefits, co-management or community-based management (CBM) of MPAs also allow time and cost efficient monitoring of resources within the protected area. Data collection on targeted resources, habitat, and its associated species by fishermen has been used and described for different fisheries worldwide (Chile, Australia, New Zealand, Spain). In the Australian abalone fishery, divers gather and process fishery-dependent information in what Prince (2003) popularized as the "Barefoot Ecologist" program. In California, the San Diego Watermen's Association (SDWA), which includes divers that target local red sea urchins *Strongylocentrotus franciscanus*, started a CB data collection program in

2001 (Schroeter et al. 2009). In collaboration with independent scientists and biologists, the SDWA developed a program to gather, organize, and analyze both fishery-dependent and fishery-independent data on the local red sea urchin fishery. These CB data collection programs are of particular importance for sea urchins and other sedentary or low mobility invertebrates (e.g. lobsters, abalones). Fine-scale spatial heterogeneity in their life history traits demands a great amount of spatial and temporal information in order to depict patterns and processes in their population dynamics needed for proper stock assessments and management plans (Butterworth and Punt 1999; Hobday and Punt 2009). This fine-scale spatial and temporal resolution in data collection and analysis has been proved extremely difficult to achieve without fishermen involvement.

Comment [ETS1]: A concluding paragraph that ties the main points above together would be helpful here!

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James Jungwirth and Kari Rein
Naturespirit Herbs LLC
P.O. Box 150
Williams OR 97544
(541) 846-7995
jk@apbb.net

RE: Small Scale Commercial Hand Harvesting of Seaweeds
May 3, 2010

Dear BRTF members,

We hope this finds you in good health.

My wife Kari and I have been sustainably *hand* harvesting edible and medicinal seaweeds from the southern Oregon and northern California coast since 1990. We process and sell these seaweeds for human consumption as dried "sea vegetables" and encapsulated seaweed products through our mail order business, Naturespirit Herbs LLC. I am also an herbal and nutritional health care practitioner and a member of the Seaweed Stewardship Alliance. Ours is a rewarding way to make a living, and we truly enjoy our work. You can learn more about what we do by visiting our website, www.naturespiritherbs.com.

We began contacting various Oregon natural resource management agencies in the 1990's in an effort to legitimize our business as well as help the state of Oregon develop a permit system for the small-scale commercial *hand* harvesting of edible and medicinal seaweeds.

In July of 2000 we received from OPRD a five-year experimental permit to *hand* harvest several species of seaweed from the ocean waters adjacent to Samuel Boardman State Park in southern Oregon. This permit was concurrent with a research study to determine sustainable levels of harvest of these seaweed species, *using our harvest methods*. The study was funded by a grant from Oregon Sea Grant and conducted by Lynda Shapiro at OIMB.

The results of the OIMB research study were very encouraging. There were no measurable long-term impacts, including the plots where 50% of the biomass had been harvested (we limit our own harvest to 25% maximum; this preserves the integrity of the seaweed cover).

This study confirmed our own conclusions. We have been carefully observing our harvest areas over the last 18 years, and we have never detected any year-to-year impact from our harvesting.

Needless to say, harvesting a few tons of seaweed by hand is extremely gentle on the ecosystem when compared with harvesting thousands of tons mechanically (using boats

with cutters). *When we harvest, we cut each plant in a way that allows it to continue to grow and reproduce*. In fact, it usually takes a trained eye to see that an area has been harvested at all. We also rinse off any clinging crabs, snails or shrimp back into the ocean as we harvest. This is simply not possible when harvesting with mechanical equipment.

There is a healthy demand in this country for clean, high quality, sustainably harvested Pacific Coast sea vegetables. Most Asian sources are moderately to severely polluted. New Zealand does not allow the importation of Japanese seaweeds because they often contain unacceptable levels of heavy metals. Our relatively unpolluted northern California coast provides much cleaner seaweeds.

Even though the hand harvesting of seaweeds for human consumption provides a large amount of employment in relation to the small amount of resources used, in our opinion the most compelling reason to encourage the small-scale commercial hand harvesting of seaweeds for human consumption is not economic, but *humanitarian*: northern California's seaweed resources provide some of the most nutritionally and therapeutically valuable foods on earth, and have enormous potential for improving the health of the people of the United States.

Can one put a price on human health? What is the value of preventing just *one* case of breast cancer?

To better understand this enormous potential for improving the health of the people of the United States, please refer to the enclosed summary of a "Seaweeds and Human Health" lecture I will be giving this summer at an herbalists' symposium in Oregon. Please keep this humanitarian factor in mind when making your decisions.

Also please consider the fact that seaweed harvester John Lewallen will lose 40% of his seaweed harvest area if the Point Arena SMR is implemented as is. This is a huge impact to our small industry because of the limited number of productive rocky intertidal areas that have safe and economically viable access. If the Point Arena SMR is implemented as is, we will have to re-distribute the areas that remain.

We therefore request that you change the designation of a nearshore strip of the Point Arena SMR to a SMCA that allows the hand harvesting of edible and medicinal seaweeds. By the way, Sea Lion Cove SMCA does not contain viable harvestable seaweed resources, and allowing harvest there is redundant.

The community based arrays (B, F, G and H) would all have a minimal impact on our harvest activities. These arrays have broad-based input and support and exceed all of the MLPA goals and guidelines.

On the other hand, there are also several other arrays (C, D and E) that have been independently created and proposed by various conservation groups and have had very little community input or support.

If adopted, these arrays would seriously impact our industry as well as our local economies.

Our local governments and ocean users fear that "big green" environmental organizations will again co-opt the MLPA process like they did on the North Central coast and push their own agendas by getting large numbers of their relatively uninformed members to write letters of support for poorly planned arrays that have not taken local economic and cultural impacts into consideration at all. This gives a false appearance of community support.

Eric Bjorkstad of the SAT stated that the difference in conservation value between the community-based vs. the conservation groups' arrays is about 1%. However, according to Ecotrust's data, the difference in economic impact between the community-based vs. the conservation groups' arrays (not including local multipliers) is about 3%. Is this a fair trade?

Also, just to give a bit of perspective on what we are debating with this process, please remember that the MLPA requires only *three* MPA's north of Point Conception!

Thank you for your time and consideration in this matter.

Sincerely,

James Jungwirth and Kari Rein

SEAWEEDS AND HUMAN HEALTH

Class notes from the 2010 Northwest Herb Fest

Seaweeds are plant-like ocean organisms that are botanically classified as macrophytic marine algae. Marine algae have been divided into three main groups, based more on their pigments and coloration than their genetics: red marine algae (Rhodophyta), brown marine algae (Phaeophyta) and green marine algae (Chlorophyta). "Kelp" is a somewhat vague term that loosely refers to the larger brown seaweed species. Edible seaweeds are often called "sea vegetables."

In botanical terminology, seaweeds have holdfasts, stipes and blades (or fronds) instead of roots, stems and leaves. Their holdfasts function simply as anchors, and do not extract nutrients as do the roots of higher plants. Seaweeds absorb and concentrate nutrients directly from seawater. They do not make flowers or seeds, but reproduce by a mind-boggling (and perhaps even immoral) variety of complex reproductive schemes, most of which involve sperm, ova, and free-swimming "spores."

Seaweeds come in an amazing variety of beautiful shapes, colors and sizes, and are found in all of the world's oceans. They are most abundant in shallow rocky coastal areas, especially where they are exposed at low tide.

Coastal people around the world have been harvesting and eating sea vegetables since the beginning of time. In the United States and Europe, increasing numbers of people are learning that eating sea vegetables can provide a broad range of health benefits.

Seaweeds are usually preserved by drying. This is the easiest and best way of preserving their flavor, nutrition and bioactivity. Most dried sea vegetables maintain their quality very well for a year or two if kept away from moisture, light and heat (like crackers, their flavor slowly fades, but nutrition and bioactivity are not affected). They keep very well in airtight glass jars in a dark cupboard.

Sea vegetables are some of the most nutritionally and therapeutically valuable foods on earth. Their value to human health is largely due to their high mineral content and to the therapeutic sulfated polysaccharides they contain. Seaweeds are also an abundant source of all the known vitamins (including B12), chlorophylls, lignans, polyphenols and antioxidants.

Many chronic diseases will improve or resolve simply by adding seaweeds to the diet. Eating sea vegetables regularly can facilitate the excretion of heavy metals, radioactive elements, dioxins and PCBs from our bodies, promote a healthy immune system, prevent thyroid disease, obesity, cancers and metastases, cardiovascular disease, type 2 diabetes, nervous system disorders, osteoporosis, reduce chronic inflammation, inhibit viruses (including herpes and human papilloma virus), and help regulate menses. In fact, the Japanese people's remarkable longevity and extremely low incidence of cardiovascular disease, thyroid disease, breast cancer and prostate cancer may largely be due to the fact that they have the world's highest per capita seaweed consumption!

Although many people eat sea vegetables as "health foods," others consider them to be delicious gourmet foods, and eat them purely for gastronomic pleasure. They come in a wide variety of tastes and textures. Some sea vegetables may be eaten dried as salty snacks, like potato chips or jerky. Others are re-hydrated, cooked until tender, and eaten alone or in myriad recipes. Powdered seaweeds may be added to smoothies or sprinkled on foods as a salty condiment. Some people prefer the convenience of taking them in capsule form. There are several very good sea vegetable recipe books; these are listed in the bibliography.

How much is good to eat? Three to six grams per day or 1 to 1.5 ounces of dried seaweed per week is a good average dietary amount for nutritional or therapeutic purposes. (That's about 3 to 5 pounds per person per year.) Dr. Ryan Drum recommends eating both brown and red seaweeds in a 2 to 1 ratio for general health purposes. Small amounts taken with each meal every day would provide maximum benefit. Chew your seaweeds well. Powdered seaweeds are often easier to digest than whole seaweeds. If you experience gas or loose stools when you first start eating seaweed, try eating less and slowly increase the amount after a few weeks. The body and the digestive flora may take up to 3 months to learn to efficiently digest seaweeds.

Phycophobia: Many American and European people have varying degrees of cultural phycophobia (fear of seaweed) although this is slowly changing. Others do not want to eat seaweeds simply because they are reminded of the rotting piles of seaweed they have seen washed up on the beach; this is like not wanting to eat vegetables because you have seen a compost pile!

What about arsenic? In April of 2007, Amster et al. published an inflammatory article about arsenic in kelp (Case Report: Potential Arsenic Toxicosis Secondary to Herbal Kelp Supplement. Eric Amster, Asheesh Tiwary, and Marc B. Schenker *Environ Health Perspect*. 2007 April; 115(4): 606–608.). Although the article largely consists of an obvious jump to a preconceived conclusion, it has been widely bandied about in the medical community as "proof" that kelp and other seaweeds are unsafe for human consumption. This is simply not true. (Do you remember when Echinacea caused autoimmune disease?)

Seaweeds naturally contain an average of about 30 parts per million (ppm) by dry weight of arsenic. The USDA has no standards for allowable levels of arsenic in seaweeds. However, the European Pharmacopoeia (European Pharmacopoeia Commission 2007) allows up to 90 ppm of arsenic in kelp for use in medicinal products. Also, most of the arsenic in seaweeds occurs in the form of organically bound arsenic compounds, which are relatively nontoxic.

Most seafoods also contain moderate amounts of arsenic, and although they are usually consumed in much larger amounts than seaweeds, this is apparently not considered to be a health risk. If the arsenic in seaweed really was a health risk, the Japanese people, who have the world's highest per capita consumption of seaweed, would all have chronic arsenic poisoning. They do not. As mentioned earlier, the Japanese people are some of the healthiest and longest-lived people in the world.

Seaweeds and water pollution: Seaweeds are at the bottom of the food chain and are therefore not prone to bioaccumulation of pollutants. However, seaweeds can absorb considerable amounts of heavy metals or radioactive elements if they are growing near a local point source of these pollutants, such as a nuclear power plant, mine, smelter, chemical plant, paper mill, landfill, waste dump, chemical agricultural region etc. Heavy metals or radioactive elements can also be carried from these sources to the sea by rivers and streams.

Buying sea vegetables: Be cautious when buying imported sea vegetables. There is usually no way of knowing where or how these seaweeds were grown. Most of the seaweeds from Japan and other Asian countries are grown on aquaculture farms. Some are fertilized with chemical fertilizers; many are grown in polluted waters.
On the other hand, most of the seaweed harvesters in the USA and Canada are small scale, ecologically sustainable hand harvesters of clean wild seaweeds.

Most commercial kelp meals and powders come from eastern Canada, Norway or Iceland. These are often very inexpensive, but seem to be of universally poor quality in terms of smell and taste.

Harvesting your own seaweeds (see bibliography for more info): Harvest from cleanest waters you can find. Ask local people, environmental groups and government agencies (such as the EPA) about local pollution sources before harvesting. Most states allow the personal harvest of 10 pounds or so of fresh seaweed per day without a permit.

Go to your harvest area at low tide, and carefully cut seaweed from the rocks, leaving the holdfasts and the base of the blades or fronds for regrowth. Harvest no more than 25% of the plants in a stand. Rinse any snails or sand off in the sea as you harvest. Fresh seaweed is as perishable as fresh fish; keep it cool and moist until you are ready to start drying it.

Dry seaweeds outdoors in full sun or in a warm, dry, well-ventilated room. Dry them as quickly as possible and do not allow them to re-dampen once they begin to dry. Hang larger seaweeds on ropes using clothespins; spread smaller seaweeds on nylon screens. If necessary, finish the drying in a heated room. Seaweeds are not fully dry until they snap crisply when bent. Store dried seaweeds in a cool dark place in airtight jars or buckets (or double bag them in heavy-duty food grade polyethylene bags).

Minerals: Seaweeds are by far the most concentrated natural food source of minerals, electrolytes and trace elements (20 to 50% of dry weight) in a ratio that is remarkably similar to that of our own blood. This similarity may not a coincidence, since marine algae were presumably the first foods available to the first animal life on this planet.

Ever since the time our distant ancestors left the ocean and began to live on land, our bodies have had to work much harder to find, ingest, absorb and selectively retain or excrete minerals in order to maintain the "internal ocean" (blood plasma and interstitial fluid) that bathes and feeds our cells.

The ratio and concentration of minerals in our blood plasma and interstitial fluid is so vitally important that our bodies will steal minerals from our bones and other tissues to maintain it. Ongoing mineral deprivation of bone and other tissues can result in chronic disease (Paul Bergner does a wonderful job of documenting the connection between dietary mineral deficiencies and chronic disease in his book, "The Healing Power of Minerals").

Eating seaweeds regularly may be the best way to be sure that we are ingesting enough of all the minerals we need for optimum health. This is especially important today because modern chemical farming, depleted soils and processed foods have resulted in widespread mineral deficiency-caused disease.

Essential minerals and trace elements found in seaweeds include boron, calcium, chloride, chromium, cobalt, copper, fluoride, iodine, iron, lithium, magnesium, manganese, molybdenum, potassium, phosphorus, selenium, silicon, sodium, sulfur and zinc. The amounts of each mineral varies widely between species, season of harvest and area of harvest.

The electrolytes: potassium and sodium: Potassium and sodium are the two most important electrolyte minerals. Adequate potassium and sodium is necessary for proper functioning of our nervous system, muscles, heart, kidneys and pancreas, and for regulating blood pressure and blood sugar.

Most people are aware that too much sodium in the diet can cause hypertension (high blood pressure). However, the level of sodium in one's body is actually less of an issue than the sodium-to-potassium ratio. An excessive sodium-to-potassium ratio in the body causes it to retain water and increase blood volume, causing hypertension.

Most western diets provide too much sodium and not enough potassium. Excessive sodium intake washes potassium out of the body through the urine. Potassium deficiency can also be brought on by medications such as diuretics and cortisone.

Increasing dietary potassium can also help the body adapt to stress (our bodies respond to stress by retaining sodium and excreting potassium through the urine).

Seaweeds are some of nature's most concentrated sources of potassium and sodium, in a nearly ideal ratio. Their salty taste is mostly due to their high potassium content; potassium is much saltier to the taste than sodium. Dr. Ryan Drum has observed that a craving for salt is usually a misplaced craving for potassium, since the human tongue cannot distinguish between the two, and sodium deficiency is extremely rare. So if you crave salt, eat some seaweed!

Blood sugar regulation: Eating seaweed can help people regulate their blood sugar better. Potassium, chromium, magnesium and other minerals are essential to blood sugar regulation. Also, the polysaccharides in seaweeds slow the absorption of dietary sugars and help prevent blood sugar and insulin spikes.

Type 2 (adult onset) diabetes is largely the result of a diet that is high in empty calories (refined sugars, fats and starch) and low in the vitamins and minerals needed to burn them (eat your vegetables!). Their bodies have had no choice but to store these empty calories; eventually, all of their cells become so full they can't fit any more in response to insulin, hence the name "insulin resistant diabetes." Type 2 diabetes has also been linked with low thyroid function, chronic stress, high cholesterol, obesity etc.

Seaweeds also often benefit people with hypoglycemia (low or unstable blood sugar, often associated with high carbohydrate, low fat and low protein diets). If you give seaweed (especially Kelp Fronds) to kids that have had too much sugar or who are crashing from low blood sugar, it's amazing how fast it grounds their energy!

Nervous system disorders and muscle spasms: Most seaweeds have a distinct calming effect on the nervous system and muscles, and eating them regularly can often help or even resolve ADHD, nervousness, irritability, anxiety, depression, insomnia, fibromyalgia, muscle spasms, tics and restless legs syndrome. The high levels of potassium, sodium, calcium, magnesium, and other minerals in seaweeds are food for the

nervous system and muscles, and are largely responsible for this calming effect. Many brown seaweeds also contain surprisingly high levels of melatonin, which may also play a part. Nervous system and muscle disorders are also often closely linked to blood sugar regulation and thyroid function.

Iodine: The thyroid gland needs iodine to produce thyroid hormones, which regulate our metabolism, circulation, energy level, sense of well-being, immune system, and growth of skin, hair and fingernails. Iodine is also essential to healthy breast, ovary, testes, prostate and salivary gland health and function.

Most Americans do not get enough dietary iodine. Chlorinated water, fluoridated water and toothpaste, aspirin and many prescription drugs increase the need for dietary iodine. Land plants are not a reliable source of iodine; most seaweeds contain hundreds of times as much as any land plant. The brown seaweeds, especially Kombu *(Laminaria spp.)* are especially high in iodine. Consumption of 3 to 6 grams of most dried seaweeds daily will provide adequate dietary iodine. Excess iodine is easily excreted through the urine.

Seaweeds and thyroid function: Bladderwrack *(Fucus spp.)* Kombu *(Laminaria spp.)* and Sargasso Weed *(Sargassum spp.)*, which are all brown seaweeds, have a long history of use in different parts of the world to prevent and treat underactive thyroid (hypothyroid) conditions, obesity and goiter. This is because of their very high iodine content and because much of this iodine occurs in the form of thyroid hormone precursors (MIT and DIT) that are particularly easy for the thyroid gland to assemble into thyroid hormones.

In addition, actual thyroid hormones (T3 and T4) have been found in significant amounts in Kombu and Sargasso Weed (other brown seaweeds may contain T3 and T4 as well). These seaweeds could therefore be expected to provide actual thyroid activity in the body in addition to supplying iodine to the thyroid.

Why would seaweeds bother to produce animal thyroid hormones? That is a *good* question, but it may also be the *wrong* question, because marine algae probably made T3 and T4 long before animal life existed! Marine algae were among the first foods available in the history of life on earth. It is reasonable to assume that early animal life became physiologically dependent on the constant presence of algal T3 and T4 in their diet, and later learned to make their own.

Hypothyroid (underactive thyroid) conditions are rampant and continually increasing in the USA. Symptoms include intolerance to cold, fatigue, depression, forgetfulness, slow metabolism, high cholesterol, weight gain, water retention, constipation, dry skin and hair, brittle nails, immune deficiency, muscle cramps and heavy menses. (Chronic fatigue syndrome, fibromyalgia and type 2 diabetes are also often associated with low thyroid function.) Hypothyroidism occurs much more often in women than men.

Causes of hypothyroidism include exposure to radioactive iodine (I-131), heavy metals, dioxins, PCBs, PBDEs (flame retardants), resorcinol-based glues or MTBE gasoline additives; autoimmune thyroid disease (Hashimoto's thyroiditis etc.), long term adrenal exhaustion, long term veganism, excessive consumption of soy products and insufficient dietary intake of iodine, selenium or L-tyrosine. Underactive thyroid conditions can also be a non-pathological response to grief, depression, or menopause.

Many people are successfully using seaweeds to treat their hypothyroid conditions and avoiding the use of synthetic thyroid hormones (and the associated health risks). Some people are even able to slowly wean themselves from synthetic thyroid hormones with concurrent long-term use of seaweeds. Thyroid nodules also often resolve with long term use of brown seaweeds.

In my own experience, 3 to 6 grams daily of powdered Kombu *(Laminaria setchellii)* or Bladderwrack *(Fucus gardneri)* is a highly effective treatment for hypothyroid patients. Kombu seems to be somewhat more effective than Bladderwrack.

Gotu Kola *(Centella asiatica)*, Ashwagandha *(Withania somnifera)*, Eleuthero *(Eleutherococcus senticosus)* and various species of Reishi *(Ganoderma lucidum, G. oregonense* and *G. tsugae)* or Artist's Conk *(Ganoderma applanatum)* can also be very helpful for people with hypothyroidism.

People seeking more detailed holistic information on thyroid function and disease should read Dr. Ryan Drum's brilliant thyroid articles (see bibliography).

Iodine sensitivity and hyperthyroidism: Some people are extremely sensitive to the iodine in seaweed, and may show signs and symptoms of hyperthyroidism (excessive thyroid function): nervousness, insomnia, rapid heartbeat, heart palpitations, excessive sweating etc. These people should be cautious about the amount of seaweed in their diet. People with chronic hyperthyroidism probably should not eat seaweed (especially Kombu or Bladderwrack).

Osteoporosis: The high levels of minerals in sea vegetables make them some of the world's most alkalizing foods. Maintaining an alkaline body is essential to good health in general, and to preventing osteoporosis in particular. If our blood becomes too acidic, our bodies will take calcium from our bones to buffer our blood's pH. Over time, this can lead to decreased bone density, or osteoporosis. Eating sea vegetables regularly can reduce our need for calcium/magnesium supplements and help prevent osteoporosis.

Vitamins: Seaweeds are an excellent source of all the known vitamins, particularly the B vitamins (including B-12). Vitamin content varies widely between species, season of harvest and area of harvest.

Therapeutic sulfated polysaccharides: Seaweeds contain large amounts (25 to 40% of dry weight) of therapeutic sulfated polysaccharides, including algin, fucoidan and laminarin, which are produced by brown seaweeds, and carrageenans, agar, and porphyran, which are produced various red seaweed species. These unique seaweed gels are the means by which seaweeds absorb and concentrate minerals from seawater. They also have many amazing beneficial health effects.

Water soluble fiber: All seaweed gels are relatively indigestible by humans, and act as high quality water-soluble fiber in our digestive tracts and as food for our colon flora. This may be why many seaweeds are considered to be soothing intestinal tonics in many Asian medical traditions.

Protection from heavy metals and radioactive elements: Algin, a polysaccharide found in all brown seaweed species, will bind with heavy metals and radioactive elements in the food, water and digestive juices in our gastrointestinal tract. This prevents their absorption or reabsorption and allows them be eliminated through the feces. Fucoidan, laminarin, carrageenans and agar all have similar properties. This means that eating seaweeds (especially the brown seaweeds) regularly can effectively reduce our body loads of these toxic elements. The potential value of this to human health cannot be underestimated.

The average American today has hundreds of times more lead in his or her body than a century ago, primarily because of the use of tetraethyl lead in gasoline for 65 years (it was outlawed in the USA in 1989)

and from commercial lead smelters, incinerators etc. Most Americans also have some degree of mercury toxicity from amalgam dental fillings, coal burning power plants, cement production and contaminated ocean fish. Both heavy metals can cause serious neurological disorders, autoimmune diseases, hypothyroidism, cancers and birth defects.

In 1957 the U.S. Atomic Energy Commission recommended taking five grams of powdered kelp, algin or sodium alginate daily for protection from the radioactive fallout from atmospheric nuclear testing. This is probably good health advice for today as well. Scientific studies measuring Strontium-90 in the deciduous teeth of children and the bones of adults indicated that although levels declined during the 1970's, they were as high in the 1980's and 1990's as they were during the late 1950's, when radioactive fallout from nuclear testing was at its peak. Sr-90 is the most easily traced radioactive isotope produced by atomic bombs and nuclear reactors.

It is a deplorably under-publicized fact that all nuclear power plants regularly release radioactive Sr-90 and radioactive Iodine (I-131) into the atmosphere. This Sr-90 and I-131 attaches to water droplets and dust particles and descends to the earth's surface, where they are absorbed into people's bodies through the lungs, skin, and digestive tract (as a component of air, water and food). People that live near nuclear power plants have much higher rates of autoimmune diseases, cancers and birth defects.

When absorbed by the body, Sr-90 is deposited in the bones and teeth, continuously emitting radiation as it decays (it has a half-life of about 29 years). I-131 concentrates in the tissues that need the most iodine; the thyroid gland, ovaries or testes, salivary glands and, in women, the areola of the breast as well. As the I-131 decays (it has a half-life of 8 days), it irradiates and damages these tissues, causing loss of function, autoimmune diseases and cancers. Most cancers do not show up until *at least* 15 years after exposure.

According to the National Institute of Health, the I-131 fallout from the nuclear accident at Chernobyl has also caused large numbers of people worldwide (including the United States) to contract thyroid cancer.

If a person maintains a full body load of natural iodine (I-127), the radioactive iodine is not absorbed. Seaweeds, especially the brown seaweed species, are by far the most concentrated natural food source of iodine.

Protection from dioxins and PCBs: Dioxins and PCBs are particularly insidious environmental pollutants because they are extremely toxic, extremely stable, and extremely lipophilic, and because they concentrate in animal fats as they move up the food chain. Humans get most of their dioxins and PCBs from meat and dairy products. Once ingested, dioxins and PCBs are very readily absorbed and very slowly excreted, so they tend to stay in the liver, brain and body fat for decades.

We are all carrying significant body loads of these toxins. Dioxins and PCBs are and can cause cancer, immune system damage, autoimmune disease, hormone disruption, thyroid disease, endometriosis, infertility, miscarriage, birth defects, learning disabilities, lowered testosterone levels, reduced sperm counts, diabetes, lung problems and skin disorders.

A landmark research study conducted by Morita and Nakano (Morita K, Nakano T: Seaweed accelerates the excretion of dioxin stored in rats. J Agric Food Chem 2002, 50:910-917) clearly demonstrates that regular consumption of Wakame, Kombu and Hiziki by rats reduces absorption of dioxins and PCBs from food (and

reduces the reabsorption of dioxins and PCB from the digestive juices secreted into the gastrointestinal tract) allowing them to be eliminated through the feces, effectively reducing body loads of these toxic chemicals. (Wakame, Kombu and Hiziki are brown seaweeds; I assume that it is the polysaccharides in the brown seaweeds that are binding with the dioxins and PCBs.)

Morita and Nakano's research strongly suggests that eating brown seaweeds regularly can effectively reduce body loads of dioxins and PCBs for humans as well.

Fucoidans: Fucoidans are a class of sulfated polysaccharides found in most brown seaweed species (5 to 20% by dry weight). Fucoidans have received a lot of attention from the research community because they have demonstrated so many broadly beneficial health effects. They have strong immune enhancing, immune-modulating, anti-inflammatory, antioxidant, anti-coagulant, cholesterol-lowering, anti-cancer, and anti-metastatic activity.

Immune enhancement and virus inhibition: Perhaps the most significant aspect of fucoidans is their ability to build up and strengthen the immune system. Fucoidans also possesses strong inhibitory activity against a number of coated viruses, such as HSV-1, HSV-2, HPV, EBV, CMV and HIV. Its mechanism of action involves blocking virus entry into cells, rather than killing the virus directly.

Immune modulation: Fucoidans also provide an array of health benefits via their ability to modulate the immune system. Immune modulating substances have the ability to increase immune function when it is depressed, as in conditions like chronic fatigue syndrome, and to reduce it when it is over-stimulated, as in auto-immune diseases like lupus or rheumatoid arthritis, allergies, etc.

Healing from tissue trauma: Dr. Ryan Drum has noted that consumption of fucoidan-rich brown seaweed broths seem to prevent bruising, reduce inflammation and speed tissue healing after injuries or surgery. The researched antioxidant, anti-inflammatory and anticoagulant activity of fucoidans would strongly support his observation.

Cancers and metastases: Researchers have determined that fucoidan tends to combat cancer by reducing angiogenesis (blood vessel growth), inhibiting metastasis (spreading of cancer cells to other parts of the body), and promoting death of cancer cells (apoptosis).

Seaweeds and cardiovascular health: Eating seaweeds regularly, especially the brown seaweeds, improves the quality of the blood, which is the key to cardiovascular health. Seaweed provides abundant minerals for the blood, blood vessels, heart and kidneys. It provides blood thinning, anti-inflammatory and antioxidant polysaccharides, which keeps the blood thin and easier for the heart to push through the blood vessels, prevents clots from forming, prevents free radical damage to the blood vessels and keeps plaques from clogging the blood vessels that feed the body.

The fucoidans in brown seaweeds improve lipid metabolism in the liver, which decreases the total amount of serum cholesterol and improves the ratio of good (HDL) cholesterol to bad (LDL) cholesterol. Seaweed also helps keep thyroid hormones at optimal levels, which is also supports healthy cholesterol levels and the prevention of atherosclerosis.

Blood pressure: The hypotensive effect of many brown seaweeds, especially Kombu *(Laminaria spp.)* and Bladderwrack *(Fucus spp.)* has been well established in folk medicine and with modern research.

Irregular or painful menses: Regular consumption of brown seaweeds often helps regulate the menstrual cycle. This may be due to the estrogen-lowering fucoidans and lignans or to simple thyroid stimulation.

Carrageenans: Carrageenans are immune-enhancing, broad-spectrum anti-viral (including HSV-1, HSV-2 and HPV) sulfated polysaccharides found in many red seaweed species. Some species contain more than others. The various Pacific species of the genus *Gigartina* (also known as *Mastocarpus* or Grapestone) as well as the Atlantic species *Chondrus crispus* (Irish Moss) are particularly high in carrageenans (50 to 80% of dry weight). Carrageenans are also widely used in the food industry as thickening and stabilizing agents and in cosmetic and skin care products

There are a variety of products made from different red seaweed species being marketed today for topical and internal use for suppression of herpes simplex 1 and 2, mostly under the generic name of Red Marine Algae. I have no solid data on their efficacy in real life.

Organoleptic experiment with seaweed and HSV-1: I have been using 5 to 10 grams daily of a mix of six powdered brown and red seaweeds during the last two years. I would normally have expected to get five or six outbreaks of oral herpes (HSV-1) during this time. However, during the last two years I have had only one very mild outbreak, and that was after a period of slacking off in my use of these seaweeds for a few weeks.

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